HALTON REGION 30th ANNIVERSARY

THE REGIONAL MUNICIPALITY OF HALTON

Report To:	Chairman and Members of the Planning and Public Works Committee
From:	Peter M. Crockett, P. Eng., Commissioner of Planning & Public Works
Date:	January 26, 2005
Re:	Costs/Benefits of Utilizing Garbarators to Divert Household Organic Waste
Report No.:	PPW17-05 REVISED

RECOMMENDATION

THAT Report PPW17-05 entitled "Costs/Benefits of Utilizing Garbarators to Divert Organic Waste" be received for information.

REPORT

Background

In October 1999, Council approved Halton's current Solid Waste Management Strategy that contains Strategic Directions developed through public consultation to achieve a higher waste diversion rate and extend the life of the landfill through the source separation of household organics. Halton's 2001 WasteWatch Report found the average residential garbage bag to contain approximately 40 percent organic material and 10 percent paper material that could be diverted through a source separated household organics program (refer to Report PPW14-05 on this agenda).

On November 3, 2004 Council approved Report PPW152-04, Halton's Solid Waste Management Strategy Plan – WasteThree: Organics Collection Demonstration Program and during discussions on this report staff were requested to investigate the use of garbarators and to contact other municipalities for their input into the pros/cons and to report back to Committee on their findings. The term "garbarator" is used to mean an in-sink food waste grinder and disposal unit.

Research Analysis

Halton's research indicates that a typical household participation rate for garbarators may be 20% and possibly as high as 40% if highly promoted. A pilot study conducted by the City of New York found that in areas where garbarators were allowed, less than 25% of the households had a garbarator. In Tucson, Arizona where the use of garbarators is encouraged, the participation rate is estimated at 25%. Municipalities that have implemented curbside organics collection and processing programs are experiencing participation rates in the range of 80% - 90%. The average cost to purchase and install a garbarator is approximately $630 Canadian, while the average cost to purchase a green bin for curbside collection is $30 - $40 Canadian. For comparison purposes, the capital costs were calculated with the assumption that green bins or garbarators would be purchased for 100% of the households in Halton.

Garbarators offer convenience allowing for the immediate disposal of kitchen food waste down the drain. However, this convenience needs to be balanced against the initial capital cost, maintenance and eventual replacement of the garbarator, and potential clogging of laterals and sewers. (See Attachment #1 - Article published in MSW Management entitled "Beyond the Pail, Attack of the Home Garbage Disposers").

Diversion Rate

Currently Halton achieves a division rate of over 40% which equates to a total landfill life of 31 years. With a source separated organics curbside collection and composting program, Halton's diversion rate could increase an additional 15% to 20% and extend the life of the landfill another 6 to 9 years (Refer to Report PPW14-05 on this agenda). The MOE has proposed to reach a provincial waste diversion goal of 60% by 2008. Implementation of a curbside collection and composting program should be sufficient to comply with this goal. However, based on data from the Environmental Protection Agency (EPA), the potential increase in diversion rate through the use of garbarators (even at a participation rate of 100%) would likely be in the range of 9% to 11% which will not be enough to reach the 60% goal. The higher diversion that should be achieved with a curbside organics program is mainly due to the ability to accept a wider range of materials such as fats, large bones, tissues, napkins, paper towels and pizza boxes.

Wastewater Treatment Plant (WWTP) Impacts

The approach of managing the increased organic loading realized through the use of garbarators by the existing wastewater infrastructure was reviewed and costs quantified. While this increase in organic loading has a direct impact on operating costs, (i.e. increased chemicals, power, maintenance, grit, biosolids, etc) it also utilizes a portion of the capacity allotment for future development. Various expansions to the existing facilities would be required in order to supplement this loss of development capacity.

Most of the reviewed studies agree that wastewater treatment plant expansion is typically not required up to a garbarator market penetration of 10-15%. However, that does not take into consideration the cost of accommodating future growth. With the exception of the South East WWTP, all of Halton's WWTP site capacity is allocated. There is tremendous value in this capacity and lost opportunity cost if it is used to meet alternate demands. Halton may find that there is no longer sufficient capacity to meet growth demand in situations where plant expansion is not feasible (i.e. the stream-based systems in Halton Hills). The lake-based treatment plants could require expansion sooner than has been anticipated in budget forecasts as was the case in Okotoks, Alberta.

Water Opportunity Cost

At 100% market penetration of garbarators, a total of 1600 m^3/d would be required to flush ground organics. Most of this demand is in South Halton and can be easily accommodated by our large lake-based water treatment plants. The situation in the North however is very different. At present the groundwater systems in Acton and Georgetown are at capacity. An increase in demand to service garbarators could result in further delays to the communities meeting their growth targets, per Report PPW113-04 approved by Council on July 14, 2004.

FINANCIAL/PROGRAM IMPLICATIONS

Available studies have made few if any cost comparisons between curbside collection and central composting systems versus garbarator use. Costs for alternatives will vary depending on local factors such as size, type, and cost of treatment processes and facilities. The information contained in this report is a high level cost analysis over a twenty-year period of the two diversion methods under consideration (curbside collection & central composting and garbarators).

To evaluate the preferred organic waste diversion methodology, an evaluation of the alternative programs (curbside pick-up of organic materials, and the Regional co-ordination of the installation of garbarators) has been prepared on the basis of the net present value (NPV – based on a 20 year time frame) to the alternative initiatives, which is summarized as follows:

	Curbside Collection & Central Composting	**Garbarators at 20% Participation**	**Garbarators at 40% Participation**	**Garbarators at 100% Participation**
Capital Costs				
Green Bins/Garbarators	13,877,758	$96,648,563	$96,648,563	$96,648,563
Plant Expansion	N/A	$8,263,802	$16,527,604	$41,319,011
Total Capital	13,877,758	$104,912,365	$113,176,167	$137,319,011
Operating Costs Collection & Processing/Plant	$77,208,810	$7,866,832	$15,733,664	$39,334,160
Organics Diverted (tonnes)	640,235	82,115	164,230	410,553
NPV/tonne	**$142.27**	**$1,373.43**	**$784.94**	**$431.86**
Total NPV Cost	**$91,086,568**	**$112,779,197**	**$128,909,831**	**$177,301,734**

The analyses indicate that the most cost effective method of diverting organic material from the landfill, as characterized by the lowest NPV, is achieved through a curbside collection and central composting program. The garbarator program, evaluated at 20%, 40%, and 100% participation levels, is considerably more costly than the curbside collection and central composting initiative.

It should be noted that the diverted organic tonnes noted in the preceding table will actually result in extending the life of Halton's landfill site. The imputed cost savings attributable to this diversion have not been included in the NPV calculation, these savings would be greatest when compared to any of the garbarator participation options, as reflected in the diverted tonnes.

RELATIONSHIP TO THE STRATEGIC PLAN

There is no direct relationship to the Strategic Plan - Planning & Public Works Operational Plans 2004-05.

CONCLUSION

Our research (see Attachment #2) indicates that diversion through a garbarator program alone will not be sufficient to achieve the proposed Provincial diversion goal of 60% by 2008. However, a source separated organics curbside collection and composting program implemented Region-wide is more cost efficient and will allow Halton to reach the 60% goal, therefore extending the life of our landfill an additional 6 to 9 years.

Respectfully submitted,

Dave Clancy Director, Environmental Services	Peter M. Crockett, P. Eng., Commissioner of Planning and Public Works

Approved by

A. Brent Marshall
Chief Administrative Officer

If you have any questions on the content of this report, please contact: Dave Clancy Tel. # 7602

HALTON REGION 30th ANNIVERSARY

Attachment #2 to PPW17-05

Planning & Public Works Department
INTER-OFFICE MEMORANDUM
Environmental Services

TO: Dave Clancy, Rob Rivers, Benson Leung, Geoff Linschoten, Kiyoshi Oka

FROM: Garry N. Boychuk, P.Eng.
Shirley McLean, P.Eng.

DATE: January 17, 2005

RE: Organics Source Separation Curbside Collection and Central Composting Versus Garbarators and Co-Digestion

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Introduction

In October 1999, Council approved Halton's current Solid Waste Management Strategy that contains Strategic Directions developed through public consultation to achieve a higher waste diversion rate and extend the life of the landfill through the source separation of household organics. Halton's 2001 WasteWatch Report found the average residential garbage bag to contain approximately 40 percent organic material and 10 percent paper material that could be diverted through a source separated household organics program.

Separating organic material from the garbage for composting reduces the amount of waste going to landfill while producing a valuable soil amendment product that can be used in gardens, landscape rehabilitation projects, container plantings, and agricultural applications. Compost helps to improve the texture and moisture retention qualities of soil.

On November 3, 2004 Council approved Report PPW152-04[1], which recommended establishing a Source Separated Household Organics Collection Demonstration Program within Halton. Council requested information comparing the cost/benefits of utilizing "garbarators" as a method to divert organic waste from landfill in Halton Region. The term "garbarator" is used to mean an in-sink residential or commercial food waste grinder and disposal unit.

This memo details the review and evaluation of the merits of source separated organics collection and central composting versus garbarators and co-digestion at Halton's Wastewater Treatment Plants.

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[1] Halton Staff Report PPW 152-04, Halton's Solid Waste Management Strategy Plan - WasteThree: Organics Collection Demonstration Program

This study is comprised of:

- Literature Review of Relevant Reports and Studies
- Cost Analysis
- Cost Comparison
- Discussion
- Conclusions
- Recommendations

Much study and evaluation of the advantages and disadvantages of garbarator/co-digestion has been undertaken both in Halton, neighbouring municipalities, and around the world. All available Halton reports have been reviewed along with available reports from neighbouring municipalities and selection of independent studies.

An exhaustive search of all relevant supporting information was not possible given time constraints. Therefore, this evaluation is presented as an order of magnitude only and intended to demonstrate the relative differences between alternatives. Further detailed study is required in order to determine precise design and performance criteria and the associated real costs with certainty.

Literature Review of Relevant Reports and Studies

The following is a synopsis of available relevant reports and studies:

A 1965 investigation[2] by the Town of Burlington Director of Public Works R. Bailie summarized information from Metro Toronto and the wastewater authority, Ontario Water Resource Council, and determined that at a typical market penetration of 10%, grinders would have little effect on wastewater treatment plant costs or capacity and likewise results in little waste diversion from landfill. The largest concern by far was the possibility of sewer clogging. This concern was limited to undersized sewers, sewers with poor slope, and small sewers serving large apartment complexes. Another noted effect reported in the United States was a significant increase in rats found in the sewers. As a consequence, garbarator use was, and continues to be, restricted by Halton By-laws 2-03 and 184-95. Garbarators can only be installed by written request to the Region and subsequent approval by the Director of Waste Management.

In November 1989, Environmental Science and Engineering published an article[3] by Dr. P.H. Jones, P. Eng., extolling the virtues of garbarators. The article identified that wastewater collection and treatment systems are suited to transport and treat organic kitchen wastes but did not identify the costs. Dr. Jones followed this with a November 1990 study[4] funded by Emerson Electric, which proposed three viable alternatives to landfilling organics:

1. Source Separate and home compost;
2. Source Separate, transport, and centrally compost;
3. Grind, and flush with a garbarator for processing, and treat at wastewater treatment plants.

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[2] Town of Burlington memo, Re: Garbage Disposal Units, R. Bailie, P. Eng., August 20, 1965
[3] Home Garbage Grinders – the real facts, Environmental Science and Engineering, Dr. P.H. Jones, P. Eng., November, 1989
[4] Kitchen Garbage Grinders – The effect on the sewerage system and refuse handling, Dr. P.H. Jones, P. Eng., November, 1990

A fourth possible alternative: Separate, transport, and co-digest at wastewater treatment plants was not evaluated. The report identified the limitation of home composting to those with space. Central composting was identified as a "solution which should be considered and public health issues carefully scrutinized". Dr. Jones' study in Penetanguishene was limited to garbarators only and involved only 45 houses out of 1200 total or 3.5%. The conclusions indicated little reduction in garbage generated and no impact on quality or quantity of sewage reaching the Wastewater Treatment Plant (WWTP). Consequently, no costs were evaluated.

The Jones' article generated a November 1989 memo[5] by the Oakville Mayor Ann Mulvale requesting the Public Works Commissioner, Bob Moore to investigate. It also generated a critical rebuttal from J. A. Stephenson, P. Eng. in a November 1990 Gore and Storrie memo[6]. Both of these were compared in a February 1990 memo[7] from the Director of Waste Management J.R. Mackay to Bob Moore, and became the basis for a Halton staff report,[8] reiterating Halton's concern of sewer blockages. Report PW 63/90 agreed with Mr. Stephenson that WWTP loads and operating costs would increase with garbarators and disagreed with Dr. Jones that a central composting program could not be run economically and safely. The report concluded as follows:

> "We are unable to quantify the cost of upgrading sewage collection mains and wastewater treatment plants versus implementation of a separate collection system for solid waste organics and construction of compost facilities. However, we believe in light of the considerable disruption to upgrade wastewater treatment systems, it will be more viable, both economically and otherwise, for Halton to invest in a separate composting program. Again to quote from Stephenson, "It rarely makes economical sense to add something to water and then remove it later."

The report recommended maintaining restricted use of garbarators and this remains Halton's policy to this day.

Due to the perceived convenience of flushing organics down the drain, the solid waste industry continued to promote the use of garbarators in Civic Public Works, April 1991[9], and as recently as November 1998 in WasteAge[10]. Only in the WasteAge article were sewage treatment costs identified, but these were incomplete. The article assessed annual plant operating costs but did not account for garbarator capital and maintenance costs, plant expansion costs, plant opportunity costs, or life cycle costs.

Dr. Jones pursued the study of garbarators at Griffith University in Australia, on behalf of In-Sink-Erator, manufactured by Emerson Electric. His August 1994 report[11] found in favour of garbarators concluding: "Food Waste Disposals do not present an unmanageable load on existing sewage treatment facilities".

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5 Town of Oakville memo – Garburators, Mayor Ann Mulvale, November 30, 1989
6 Response to "Home garbage grinders – the real facts" by P.H. Jones, P.Eng. Env. Sci & Eng., 2(6), Nov, 1989, p. 6, J.A. Stephenson, P. Eng.
7 Re: Garbage Grinders (Garburators), J.R. Mackay, P. Eng., February 6, 1990
8 Halton Staff Report PW 63/90, Garbage Grinders, R.W.J. Moore, P. Eng., February 20, 1990
9 Garbage grinders may provide alternative to landfilling, Janice Samuels, Civic Public Works, April 1991
10 Food Disposers Help Grind Down Solid Waste Problems, Kendall Christiansen, November 1, 1998
11 Economic and Environmental Impacts of Disposal of Kitchen Organic Wastes using Traditional Landfill – Food Waste Disposer – Home Composting, Dr. P.H. Jones, P. Eng., August, 1994

No costs were presented.

In September 1999, the Region of Peel produced a memo[12] discussing the effect of garbarators on the Peel wastewater system. Highlights are as follows:

> "Garbarator use leads to a significant increase in the volume of solids produced, which in turn might require the expansion of existing facilities."…. "Problems with grease accumulation and pump maintenance have also been associated with the use of garbarators."

The memo summarized findings from a City of Guelph report as follows:

- WWTP loadings increase is in agreement with Environmental Protection Act (EPA) data.
- Grit increases in volume up to 40%.
- "Volume of solid waste is not significantly reduced due to the density of food wastes."
- "Garbarators are not consistent with a municipal composting program. Economies of scale are not realized if food wastes must be dealt with in more than one way."
- "Determining actual costs of garbarators will require a more detailed study."
- "Many municipalities allowing garbarator use do not know the full impact of their use on wastewater systems."

Survey of Surrounding Municipalities:

- Durham – permits use of garbarators
- Hamilton – has no formal restriction on garbarators
- Niagara – has no restrictions on garbarators
- Toronto – garbarators are permitted except in areas with combined sewers
- Guelph – garbarators banned in favour of source separation and central composting

A life cycle analysis was conducted by the Cooperative Research Center (CRC) for Waste Management and Pollution Control Ltd and a report[13] published in December 2000. The study compared garbarators, co-disposal (landfill), central composting, and home composting.

> "The study indicates that Home Composting is the least expensive option while garbarators are the most expensive. The cost to the resident of Co-Disposal and Centralized Composting are in between these two extremes, with that of Centralized Composting being marginally cheaper."In September 2001, Halton commissioned a feasibility study of co-digestion of source separated organics[14]. The study considered source separation and cost of trucking food waste directly to Halton WWTPs and co-digested in the anaerobic digesters along with the sewage sludge. Although there is a demonstrable savings by not having to construct dedicated central composting facilities, the negative impacts are many as listed below:

[12] The Effect of Garburators on the Region of Peel Wastewater System, Mark Schiller, P. Eng., September 9, 1999
[13] CRC Assessment of Food Disposal Options in Multi-unit Dwellings in Sydney, Dec 2000
[14] Feasibility Study for the Co-Digestion of Residential Source Separated Organic Wastes at Existing Wastewater Treatment Plants in the Region of Halton, R. Cave and Associates – Trow Consulting Engineers Ltd, September 2001

- Opportunity cost of using digester capacity
- Significant truck traffic increase
- Additional space requirements
- Additional equipment requirements
- Significant risk of odour
- Negative impact on equipment
- Complicated MOE approvals process

In June 2004, the Town of Okotoks, Alberta, commissioned a study[15] of the effect of garbarators on their WWTP. The most prominent finding:

> "It is expected that the impact of prohibiting further installation of garbarators in new developments and conducting a community awareness program regarding the benefits of removal of garbarators currently in use, could result in a reduction of waste loading to the Okotoks treatment plant by up to 20% in the next few years. In addition to saving substantial operating costs each year as Okotoks grows, the future estimated capital cost of $6.4M for the Stage 2 expansion planned for 2009, could then be deferred by approximately 3 years."

The Town of Okotoks has a draft by-law banning garbarators effective January 1, 2005.
The Consultant also included a survey of other municipality's policies as follows:

- City of Ottawa – By-law banning garbarators due to impact on WWTPs
- City of Winnipeg – Residential garbarators permitted. Considering prohibiting new installations. Sewer lateral plugging is a problem.
- City of Calgary – No formal policy. Encourages home composting.

Cost Analysis

With the exception of the CRC and Trow studies, available studies have made few if any cost comparisons, and it is apparent the question of whether or not to promote and use garbarators can only be answered with a cost analysis and comparison of various alternatives. As well, costs for alternatives will vary depending on local factors such as size, type, and cost of treatment processes and facilities. Consequently, Halton has undertaken a feasibility study that includes an order of magnitude cost analysis of the two disposal methods under consideration.

1. Garbarators and Co-Digestion at Wastewater Treatment Plants Assumptions

    Market penetration

    20% - Typical of municipalities that do promote,
    40% - Likely best case for municipalities that do promote,
    100% - used for diversion and cost comparison purposes, not practically achievable.

    Garbarator Cost

    Three verbal quotes were solicited for an average installation & wiring cost of $633

[15] Impact of Household Garbarators on Wastewater Loadings, Stantec Consulting Ltd, June 14, 2004

Garbarator Loadings

Food waste is considered 30% solids by weight.

Diversion per EPA 2.8 wet kg/hh/wk

Per EPA guidelines:	BOD_5	18 g/cap/d average
	TSS	26.5 g/cap/d average
	TP	0.1 g/cap/d, ruled insignificant and not factored
	N	0.6g/cap/d, ruled insignificant and not factored

WWTP performance based on 2003 benchmarking costs for BOD removal through aeration and TSS removal, stabilization, and disposal at all 7 WWTPs. Maintenance and manpower costs assumed unaffected.

BOD and TSS removal costs calculated by ratioing garbarator loadings to current removals.

WWTP effluent quality unaffected.

Extra chemical costs not included

WWTP expansion costs $1M/MLD

<u>Wastewater Treatment Operating Cost, Quantitative, Qualitative</u>

An analysis of typical loadings of garbarators use against actual 2003 performance of all seven of Halton's WWTP revealed an average 21% increase in loadings for 100% market penetration (see Attachment #3). This compares favourably to City of Guelph range of 10% to 35% and Dr Jones' determination of 18%. Unique plant percentages were calculated and used as annual cost ratios against 2003 plant benchmarked costs. These costs were broken down into unit process and utilities affording us the opportunity to determine the proportional cost increase of each unit process for each plant. A proportional increase of 22% for all Halton WWTPs was also calculated from fundamentals (see Attachment #4). For the unlikely case of 100% market penetration, a garbarator diversion program would cost our wastewater treatment operations $1.9M annually. A more likely market penetration of 20% would cost our operations $375,000 annually. Although harder to quantify, there are real costs associated with extra organic solids and grit in our wastewater collection and treatment systems. Grit handling, chemical use, equipment wear, and odour will all increase with inherent costs and negative perception, particularly for odour. Currently Halton is expanding much effort and expense evaluating odour levels at many of our WWTPs, and installing odour control equipment where warranted. Additional organics with associated odour potential would run counter to this effort. These costs have not been assessed or quantified. As such, the calculated operating costs are conservative.

<u>Wastewater Treatment Opportunity Cost</u>

Most of the reviewed studies agree that WWTP expansion is typically not required up to 10% to 15% garbarator market penetration. That may indeed be the case, but what is not taken into consideration is the cost of accommodating future growth. With the exception of the South East WWTP, all of Halton's WWTP excess capacities is allocated for approved future growth. There is tremendous value in this excess capacity and an opportunity cost if it is used to meet a different demand. Not unlike the Okotok predicament, Halton may find that there is no longer sufficient capacity to meet growth demands in situations where plant expansion is not feasible (i.e. the stream-based systems in Halton Hills). The lake-based treatment plants could require expansion sooner than has been anticipated in budget forecasts and in larger steps to accommodate increasing loadings.

For the unlikely case of 100% market penetration, a garbarator diversion program would force expansion of our wastewater treatment plants at a cost of $41.3M. Although 100% penetration is highly unlikely, a more reasonable program of 20% would still cost Halton $8.3M

Water Opportunity Cost

At 100% market penetration of garbarators, a total of 1600 m^3/d would be required to transport ground organics. Most of this demand is in the South of Halton and can be easily accommodated by our large surface water treatment plants. The situation in the North is very different. At present the groundwater systems in Acton and Georgetown are at capacity and approval for several developments has been denied until additional capacity can be found. An increase in demand to service garbarators could result in further delays to the communities.

Biosolids Treatment and Costs

Biosolid treatment and disposal costs have been captured under wastewater treatment operating costs above.

2. Organic Source Separation and Central Composting

Assumptions:
Total waste generation 12kg/hh/wk
Organic waste generation 4 kg/hh/wk
Co-collection costs $70/tonne on all materials (waste & organics)
Organics processing costs $110/tonne

There is the potential to develop a partnership with a neighbouring municipality for the processing of the household organic material that is collected within Halton instead of constructing a new facility. The Region of Peel and the City of Hamilton to the east and west of Halton are implementing household organics programs with processing facilities, and Guelph to the northwest has an existing processing facility already in operation.

Cost Comparison

To evaluate the preferred organic waste diversion methodology an evaluation of the alternative programs (curbside pick-up of organic materials, and the Regional co-ordination of the installation of garbarators) has been prepared on the basis of the net present value (NPV) to the alternative initiatives. The analyses assume:

- A twenty-year time frame over which the alternatives have been evaluated
- That the annual growth in waste volumes are assumed to increase at an average of 2% per annum throughout the twenty-year evaluation period.
- That the opportunity cost of replacing the landfilling has been not been included.

- The analyses were also viewed from the perspective of the NPV cost of organics diversion as extrapolated on a per tonne basis.

	Curbside Collection & Central Composting	**Garbarators at 20% Participation**	**Garbarators at 40% Participation**	**Garbarators at 100% Participation**
Capital Costs				
Green Bins/Garbarators	$13,877,758	$96,648,563	$96,648,563	$96,648,563
Plant Expansion		$8,263,802	$16,527,604	$41,319,011
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Organics Diverted (tonnes)	640,235	82,115	164,230	410,553
NPV/tonne	**$102.25**	**$1,373.43**	**$784.94**	**$431.86**
Total NPV Cost	**$91,086,568**	**$112,779,197**	**$128,909,831**	**$177,301,734**

The analyses indicate that the most cost effective method of diverting organic material from the landfill, as characterized by the lowest NPV, is achieved through the curbside, "Green Bin" organics program. The net present value calculated for the Organics Program is $91,086,568 for a 20-year timeframe and the corresponding NPV/tonne diverted is $142.27.

The garbarator programs, evaluated at 20%, 40% & 100% participation levels, are considerably more costly than the "Green Bin" organics initiative. Research indicates that a typical participation rate may be 20% and possibly as high as 40%. A pilot study conducted by the City of New York found that in areas were garbarators were allowed, less than 25% of the households had a garbarator.

Discussion

Of all the literature reviewed on this subject, only two studies attempted to calculate and compare the costs of the different alternatives. CRC's LCA clearly determined that garbarators are the most expensive alternative, and central composting is second in economy only to home composting. Our own cost analysis supports this conclusion.

Source separation with curbside collection and WWTP co-digestion combines the worst of the two approaches. Cost, noise, emissions, and odours from separation and trucking, coupled with the cost of treating at WWTPs. In addition, this would equate to a 30% increase in Biosolids.

With a curbside collection and central composting program, Halton's diversion rate will increase an additional 15% to 20% and extend the life of the landfill another 6 to 9 years. The Ministry of the Environment (MOE) has mandated the province reach a waste diversion goal of 60% by 2008. The curbside collection and central will be approximately 31 years. The forecasted closure date of the site under a status quo scenario would be 2023. The goal of the 1999 Solid Waste Management Strategy is to deliver over 40 years landfill capacity. While having achieved significant diversion success, the implementation of a source separated organics program is the final major diversion initiative necessary to achieve Halton's goal to double the life of the landfill site.

With a curbside collection and central composting program. Halton's diversion rate will increase an additional 15% to 20% and extend the life of the landfill another 6 to 9 years. The Ministry of the Environment (MOE) has mandated the province reach a waste diversion goal of 60% by 2008. The curbside collection and central composting program should be sufficient to comply with this goal. However, based on data from the Environmental Protection Agency (EPA), the potential increase in diversion rate through the use of garbarators (even at a participation rate of 100%) would likely be in the range of 9% to 11% which will not be enough o reach he 60% goal. The difference in the overall diversion rates of the two programs is likely due to the ability of the composting program to accept a wider range of materials such as tissues, napkins, paper towels and pizza boxes. Committing to garbarators limits our options for further diversion.

Any extension to the life of our landfill defers the EA process and capital investment required to replace disposal capacity for Halton's waste once the landfill closes. It took over a decade and $8 million to obtain the approvals for the current landfill.

The most efficient method to collect organics from the curb would be a co-collection system that would likely coincide with a new collection contract. Purchasing co-collection vehicles at this time would minimize cost implications of the program. There is the potential to develop a partnership with a neighbouring municipality for the processing of the household organic material that is collected within Halton instead of constructing a new facility in Halton. In order to transport to a processing facility, Halton would need to construct and operate a transfer facility at the current landfill site. This would have a minimal impact to the current truck trips to and from the site each day.

Garbarators allow for immediate disposal of organics offering convenience. This convenience must be balanced against the initial cost (approximately $600), unavoidable maintenance and eventual replacement of the garbarator, and potential clogging of sewers.

Although proponents of garbarator use maintain the impact on wastewater treatment plants is manageable, our evaluation demonstrates otherwise. As well as real operation cost increases, municipalities can expect increases in maintenance costs, grit volume and handling costs, odour costs and complaints, and increases in vermin populations. While land application of biosolids has long been considered an environmentally responsible option, the changing agricultural landscape along with a significant increase in Regulatory requirements, has led to a need for landfill disposal as an ongoing program contingency for excess biosolids volumes.

Also less tangible but equally real are the liabilities of having two waste disposal operations tied together. Problems and complications with MOE approvals, Certificate of Approval compliance, and excursions due to equipment failures, labour disruptions etc would only be magnified.

Though all our WWTPs successfully nitrify, food waste organics send more nitrogen into our receiving bodies. These nutrients are best put back on the land in the form of compost. As the Okotoks example illustrates, food waste loadings on WWTPs is real and comes at a substantial cost. It is significant that

Okotoks is in the process of banning future garbarators and more importantly considering removal of existing garbarators.

Conclusions

This evaluation of garbarators versus central composting has endeavoured to answer the question that previous evaluations have rarely asked regarding the cost implications of the two alternatives. Through a complete cost analysis and economic evaluation, this study has determined that even at the unlikely mandated 100% use of garbarators, only a 9% to 11% diversion rate can be achieved at a net present value cost of $177,301,734 for a 20-year time frame. In practice, it has been found that garbarators will likely only achieve a 2% to 5% increase in diversion. A source separated household organics composting program is likely to achieve a 15% to 20% diversion rate at a net present value cost of $91,086,568.

GNB/SM/gp

PLANNING & PUBLIC WORKS DEPARTMENT
Environmental Services
The Regional Municipality of Halton
1151 Bronte Rd., Oakville, ON L6M 3L1

made by gnb **date** Jan 17/05
checked by **date**

WWTP Operating Costs - ATTACHMENT #3 TO REPORT PPW 17-05

subject: impact of additional organic loading through addition of garbarators **contract no.: n/a**

Item	Skyway	SW	MidHalton	SE	Milton	Acton	Georgetown
Population served	155518	49107	62000	33491	15054	6700	32827
Plant Rated Capacity (MLD)	118	35	50	31.8	18.5	4.55	22.7
2003 Average Annual Flow (MLD)	92.49	30.47	26.57	24.15	12.61	3.78	14.6
2003 annual removal BOD_5 (kg)	4837696	1298013	1583572	975793	578324	177981	1076458
2003 annual treatment cost BOD_5	$ 472,677	$ 223,562	$ 109,106	$ 95,405	$ 149,052	$ 47,318	$ 77,415
Additional loading BOD_5 (g/cap/d)	18	18	18	18	18	18	18
Additional loading BOD5 (wet kg/hh/wk)	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Additional annual removal BOD_5 (kg)	1021753	322633	407340	220036	98905	44019	215673
Additional removal BOD_5 (%)	21%	25%	26%	23%	17%	25%	20%
Additional annual removal cost BOD_5	$ 99,832	$ 55,568	$ 28,065	$ 21,513	$ 25,491	$ 11,703	$ 15,511
2003 annual removal TSS (kg)	6417627	2043230	2695855	1703891	769258	308501	1838505
2003 annual treatment cost TSS	$ 108,699	$ 16,936	$ 198,228	$ 26,692	$ 67,751	$ 50,729	$ 35,941
2003 annual disposal cost solids	$ 2,937,110	$ 1,006,162	$ 1,131,675	$ 744,636	$ 452,744	$ 112,805	$ 478,366
Additional loading TSS (g/cap/d)	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Additional loading TSS (wet kg/hh/wk)	1.67	1.67	1.67	1.67	1.67	1.67	1.67
Additional annual removal TSS (kg)	1504248	474987	599695	323942	145610	64806	317519
Additional removal TSS (%)	23%	23%	22%	19%	19%	21%	17%
Additional annual removal cost TSS	$ 25,478	$ 3,937	$ 44,096	$ 5,075	$ 12,824	$ 10,656	$ 6,207
Additional annual solids disposal cost	$ 688,438	$ 233,901	$ 251,742	$ 141,569	$ 85,698	$ 23,697	$ 82,616
Total annual WWTP cost of extra organic loading	$ 813,749	$ 293,407	$ 323,903	$ 168,157	$ 124,013	$ 46,056	$ 104,334
Additonal loading in equivalent inflow (MLD)	21.68	7.57	6.83	5.45	2.39	0.93	2.93
Organics diverted from landfill (wet kg/hh/wk)	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Organics diverted from landfill (wet tpa)	8420	2659	3357	1813	815	363	1777
Additional water use (l/cap/d)	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Additional water consumption (m^3/d)	705	223	281	152	68	30	149
one time WWTP capacity addition	$ 21,679,023	$ 7,573,597	$ 6,834,564	$ 5,445,691	$ 2,386,897	$ 934,885	$ 2,925,178
one time gabarator installation cost	$ 32,831,578	$ 10,367,033	$ 13,088,889	$ 7,070,322	$ 3,178,067	$ 1,414,444	$ 6,930,144

Market Penetration	100%	20%	40%
Total Organics diverted from landfill (tpa)	20270	4054	8108
Total extra BOD removal cost	$ 257,684	$ 51,537	$ 103,073
Total extra TSS removal cost	$ 108,274	$ 21,655	$ 43,310
Total Solids disposal cost	$ 1,507,662	$ 301,532	$ 603,065
Regional Total annual cost of additional loading	$ 1,873,620	$ 374,724	$ 749,448
Regional Total annual cost per wet tonne diverted	$ 92	$ 92	$ 92
Regional Total equivalent additional inflow (MLD)	47.8	9.6	19.1
Regional Total cost of WWTP expansion	$ 47,779,836	$ 9,555,967	$ 19,111,934
WWTP expansion cost per wet tonne diverted	$ 2,357	$ 2,357	$ 2,357
Regional Total cost of garbarator installation	$ 74,880,478	$ 14,976,096	$ 29,952,191

Garbarator installed cost	
quote 1	$ 600
quote 2	$ 750
quote 3	$ 550
average	$ 633

GARBARATOR LOADING AT HALTON WWTPS FROM FUNDAMENTALS - ATTACHMENT #4 to REPORT PPW17-05

Item	Skyway	SW	MidHalton	SE	Milton	Acton	Georgetown	Assumptions
Total Flow (m3/d)	91,871	30,238	26,580	24,543	12,592	3,766	14,883	Plant Data
Domestic Fraction (m3/d)	73,497	24,190	21,264	19,634	10,074	3,013	11,906	80%Dom:20%Ind ?
Est Dom Population	163,326	53,756	47,253	43,632	22,386	6,695	26,459	450L/cap - CPE
Est Dom Households	54,442	17,919	15,751	14,544	7,462	2,232	8,820	3 Persons per HH ?
Typical BOD Load (kg/d)	13,066	4,301	3,780	3,491	1,791	536	2,117	80 g/cap*d - M&E
Typical TSS Load (kg/d)	14,699	4,838	4,253	3,927	2,015	603	2,381	90 g/cap*d - M&E
Typical BOD Load W/ Food Waste (kg/d)	16,333	5,376	4,725	4,363	2,239	670	2,646	100 g/cap*d - M&E
Max BOD Load W/ Food Waste (kg/d)	19,599	6,451	5,670	5,236	2,686	803	3,175	120 g/cap*d - M&E
Typical TSS Load W/Food Waste (kg/d)	17,966	5,913	5,198	4,800	2,462	736	2,910	110 g/cap*d - M&E
Max TSS Load W/ Food Waste (kg/d)	24,499	8,063	7,088	6,545	3,358	1,004	3,969	150 g/cap*d - M&E
Estimated Avg flow Increase per HH (m3/d)	327	108	95	87	45	13	53	6 L/HH*d - M&E (4-8 L/HH*d)
Estimated Max flow Increase per HH (m3/d)	436	143	126	116	60	18	71	8 L/HH*d - M&E (4-8 L/HH*d)
Primary Sludge Production (kg/d)	10,290	3,387	2,977	2,749	1,410	422	1,667	Primary Rem = 70%
Primary Sludge Production w Food Waste (kg/d)	12,576	4,139	3,639	3,360	1,724	516	2,037	Primary Rem = 70%
Max Primary Sludge Production w Food Waste (kg/d)	17,149	5,644	4,962	4,581	2,351	703	2,778	Primary Rem = 70%
Annual Primary Sludge Production (kg)	3,755,686	1,236,129	1,086,590	1,003,318	514,761	153,954	608,417	Primary Rem = 70%
Annual Primary Sludge Production w Food Waste (kg)	4,590,283	1,510,825	1,328,055	1,226,277	629,152	188,166	743,621	Primary Rem = 70%
Annual Max Primary Sludge Production w Food Waste (kg)	6,259,477	2,060,216	1,810,984	1,672,196	857,935	256,590	1,014,028	Primary Rem = 70%
Secondary Bio Sludge Production (kg/d)	3,476	1,144	1,006	928	476	142	563	PriRem = 40%, SecRem = 95%, Sec CAS SPR = 0.7 kgTSS/kg BOD5rem
Secondary Bio Sludge Production w Food Waste(kg/d)	4,344	1,430	1,257	1,161	595	178	704	PriRem = 40%, SecRem = 95%, Sec CAS SPR = 0.7 kgTSS/kg BOD5rem
Max Secondary Bio Sludge Production w Food Waste (kg/d)	5,213	1,716	1,508	1,393	715	214	845	PriRem = 40%, SecRem = 95%, Sec CAS SPR = 0.7 kgTSS/kg BOD5rem
Annual Secondary Bio Sludge Production (kg)	1,268,587	417,537	367,026	338,898	173,875	52,002	205,510	PriRem = 40%, SecRem = 95%, Sec CAS SPR = 0.7 kgTSS/kg BOD5rem
Annual Secondary Bio Sludge Production w Food Waste(kg)	1,585,734	521,921	458,783	423,623	217,344	65,003	256,887	PriRem = 40%, SecRem = 95%, Sec CAS SPR = 0.7 kgTSS/kg BOD5rem
Annual Secondary Bio Sludge Production (kg)	1,902,881	626,306	550,539	508,348	260,812	78,003	308,265	PriRem = 40%, SecRem = 95%, Sec CAS SPR = 0.7 kgTSS/kg BOD5rem
Typical Phosphorus Loading (kg/d)	523	172	151	140	72	21	85	3.2 g/cap*d - M&E
Typical Phosphorus Loading w Food Waste (kg/d)	572	188	165	153	78	23	93	3.5 g/cap*d - M&E
Max Phosphorus Loading w Food Waste (kg/d)	735	242	213	196	101	30	119	4.5 g/cap*d - M&E
Typical Estimated kg Fe Applied / d	195	64	56	52	27	8	32	2.7:1 Fe:P, Ferric at 13.8%
Typical Estimated kg Fe Applied / d W/ Food Waste	213	70	62	57	29	9	35	2.7:1 Fe:P, Ferric at 13.8%
Max Estimated kg Fe Applied / d	274	90	79	73	38	11	44	2.7:1 Fe:P, Ferric at 13.8%
Typical Chemcial Sludge Production (kg/d)	559	184	162	149	77	23	91	2.87 kgTSS/kg Fe3+ applied
Typical Chemcial Sludge Production W/ Food Waste (kg/d)	611	201	177	163	84	25	99	2.87 kgTSS/kg Fe3+ applied
Max Chemcial Sludge Production W/ Food Waste (kg/d)	786	259	227	210	108	32	127	2.87 kgTSS/kg Fe3+ applied
Total Typical Sludge Production (kg/d)	14,324	4,715	4,144	3,827	1,963	587	2,320	
Total Typical Sludge Production W/ Food Waste (kg/d)	17,532	5,770	5,072	4,684	2,403	719	2,840	
Total Max Sludge Production W/ Food Waste (kg/d)	23,149	7,619	6,697	6,184	3,173	949	3,750	
Annual Total Typical Sludge Production (kg)	5,228,271	1,720,809	1,512,637	1,396,713	716,596	214,319	846,974	
Annual Total Typical Sludge Production W/ Food Waste (kg)	6,399,139	2,106,183	1,851,391	1,709,507	877,077	262,315	1,036,653	
Annual Total Max Sludge Production W/ Food Waste (kg)	8,449,229	2,780,941	2,444,520	2,257,181	1,158,066	346,353	1,368,766	
Typical Sludge Vol m3/d	409	135	118	109	56	17	66	3.5% does not include vol reduction through digestion process
Typical Sludge Vol W Food Waste m3/d	501	165	145	134	69	21	81	3.5% does not include vol reduction through digestion process
Max Sludge Vol W/ Food Waste m3/d	661	218	191	177	91	27	107	3.5% does not include vol reduction through digestion process
Toatal Combined Sludge Prodcution Typical	11,636,318							
Total Combined Sludge Prodcution W/ Food Waste	14,242,266							
Total Combined Sludge Prodcution Max W/ Food Waste	18,805,055							
Total Combined Sludge Prodcution W/ Food Waste % Increase	**22.4**							
Total Combined Sludge Prodcution Max W/ Food Waste % Increase	**61.6**							